

We have now followed the course of the blocks along a continuous distance of 84 geographical miles—viz. 48 on the mainland and 36 on the shores of fjords and sounds.

From what I have advanced here as regards the blocks during their journey through the Balsfjord, it seems clear that their transport here cannot be ascribed to a moving stream of inland ice. The sharp line of demarcation, above which no blocks are found, seems in itself to demonstrate this. The line extending for miles along a long fjord and extensive sounds, and being so sharply defined, bespeaks that the transporting agency at work here must have been far more regular during a length of time than a stream of inland ice possibly could be. We have therefore every reason to conclude that these blocks have been carried along the level of the sea on drift-ice, i.e. shore-ice. As the block-transport appears from the first simultaneously along the long stretch of shore from the Balsfjord, and past the Troms Island, a strong in- and outflowing current during the diurnal tides has in all probability been at work at a period when the level of the sea was 120 feet higher than at present. And the strong drift of the ice outwards must have been stronger than the one inwards up the fjord. Travelled blocks of the Kval Island granite are, therefore, not found in the interior of the fjord, but the case is different along the broad sounds about the mouth of the fjord; here the in- and outflowing currents have had alternate sway, and here are also found blocks of the Divi Valley, as well as of the coast granite.

There is another important circumstance which beyond a doubt proves that the inland ice during the Glacial age cannot have moved along this fjord, scouring the bottom. Thus, if we consider the present depth, about 600 feet, and remember that the level of the sea during the Glacial age was about 600 feet higher than at present, and further that great quantities of débris must have been deposited at the bottom of the ice, it is evident that an ice-stream moving through the fjord, and a sixth part of whose volume rose above the then sea-level, must have reached several hundred feet above the former—that is, the outgliding stream must have reached several hundred feet above 120 feet, the line of demarcation for the blocks, as it then lay at least 200 feet below the sea. If, however, this had been the case, granite blocks should now be found at a far greater height than 120 feet. Neither can the Balsfjord during the Glacial age have formed a valley along which the inland ice might move, as, in this case, travelled blocks would have been found along the sides at even far greater heights.

I have, therefore, after the most careful researches here, yard by yard, and extending over many years, come to the conclusion that the Balsfjord is not of glacial origin, but formed an incision or depression in the mountains of older origin than the Glacial age. And this conclusion I believe may, in the main, apply to the question of the formation of all fjords in the north of Norway. But whether it is applicable to all fjords in the whole of Norway I shall not attempt to answer.

There may, however, be reason to assume that the explanation of the fjord-formation in parts which have lain under an earlier Glacial age as being of glacial origin, is rather based on speculation than such careful and minute researches as those I have referred to here, and which may, perhaps, contribute to prove the correct theory.

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Tromsö Museum

#### VARIABLE STARS<sup>1</sup>

THIS catalogue may be regarded as complementary to the "Catalogue of Known Variable Stars," by the same author, which was read before the Royal Irish

<sup>1</sup> A Catalogue of Suspected Variable Stars, with Notes and Observations, by J. E. Gore, M.R.I.A., F.R.A.S. A paper read before the Royal Irish Academy, May 12, 1884.

Academy, January 28, 1884. It contains a list, including lettered numbers, of 745 stars in which some change of magnitude is suspected. The stars are tabulated in order of Right Ascension for the epoch 1880°, and in separate columns are to be found particulars of the supposed change of magnitude and the authority on which the supposed change rests. In the "Notes and Observations" by which the Catalogue is followed are given particulars of the history of each star, together with observations by the author of such stars as have received attention from him. The work is accompanied by a map showing the distribution of known and suspected variable stars.

A catalogue of this character forms a valuable working catalogue for the observer's use. By further observation suspected variation will in some cases be proved to be real, and the stars claim a place in a catalogue of known variables. A claim of this kind might indeed already be made in the case of Nos. 234, 455, and 635 of Mr. Gore's list. It may just be mentioned in passing that the place of No. 234, U Canis Minoris, is incompletely given in the Catalogue. Its more exact place for 1880 is R.A. 7h. 34m. 49s., Decl. +8° 39' 5". There are other cases in which, though the period is as yet indeterminate, the fact of variation and its amount may be stated with some confidence. On the other hand further observation may tend to throw a doubt on the suspicion of change in the case of other stars, and (as our author observes) "these must of course be removed from future catalogues." In the notes to No. 287 of his Catalogue *a* Hydræ, Mr. Gore quotes remarks by Sir John Herschel, Dr. Schmidt, and Dr. Gould to the effect that the supposed variability of this star may possibly be due to the influence of its ruddy colour on the estimates of its brightness. Is it not possible that the effect of colour on estimates of magnitude as respects different observers, or the same observer at different times, has hardly received so much attention as it deserves?

Large as is the number of stars included in Mr. Gore's Catalogue, further additions might be made to it. Comparing it, for instance, with the Table of Suspected Variables extracted from Mr. Chandler's unpublished Catalogue by Prof. Pickering, and printed in his "Recent Observations of Variable Stars" in the *Proceedings* of the American Academy, we find some 30 stars which are not included in Mr. Gore's list, and it is probable that others might be found in other quarters also. Indeed the experience of most variable star observers would probably suggest the view that cases of slight but distinctly recognisable light variation are relatively numerous.

A word in regard to No. 445 in the Catalogue may possibly help to avert the chance of a little confusion in the future. This star was entered as U Bootis in Prof. Schönfeld's first Catalogue of Variable Stars, but was rejected by him in his "Zweiter Catalog." There is another star called U Bootis by Mr. Baxendell in a paper in the Manchester Lit. and Phil. Soc. *Proceedings*, vol. xxi. No. 11, the place of which, brought up to 1880, is R.A. 14h. 48m. 47s., Decl. +18° 10' 9". This star has a period of 175.5 days, with a range of magnitude from about 13.5 at minimum to about 9.2 at maximum.

In conclusion we commend to the attention of all who are interested in the subject of variable stars a work the preparation of which must have entailed on the author a considerable amount of labour both as compiler and observer.

#### NOTES

A BERLIN telegram announces the sudden death of Dr. Emil Riebeck, at Feldkirch, where he was preparing for another five years' journey. Our first review in this week's NATURE refers to some of the last results of Dr. Riebeck's journeys. Either directly or indirectly he has done good work for science in

various parts of the world." He was a liberal patron of explorers; the recent researches of Dr. Schweinfurth, in Socotra, for example, were carried out at Dr. Riebeck's expense. His death is a serious loss to science.

THE death is also announced, at the age of sixty-seven years, of Mr. W. S. W. Vaux, F.R.S., the well-known numismatist and Oriental scholar, and Secretary to the Royal Asiatic Society.

WE have still another death to record this week—that of M. Henri Tresca, an eminent French physicist and mechanical engineer. He was born at Dunkirk in 1814. He studied at the Polytechnic School, and on leaving it entered the corps of the Ponts et Chaussées, but soon afterwards quitted the service in order to devote himself to scientific study. In 1850 he was appointed principal inspector of the French Section of the Exhibition at London, and afterwards became sub-director of the Conservatoire des Arts et Métiers, and he there filled with great distinction the Chair of Industrial Mechanics. In 1872 he was elected a Member of the French Academy. Of his numerous works may be mentioned his "Cours de Mécanique Appliquée" and his "Écoulement des Liquides." The Academy of Sciences, on hearing of his death from the President, M. Boulay, closed the sitting as a mark of grief.

WE are informed that Dr. Barius, Surgeon-General to the French army in Tonquin, died on the 10th in Haiphong after a short illness caused by overwork and anxiety in that unhealthy climate. Dr. Barius is well known to the scientific world from his meteorological writings, especially his able and exhaustive "Recherches sur le Climat du Sénégal." While in Haiphong Dr. Barius took the trouble to make observations every day at 10 a.m. and 4 p.m., which he reduced and forwarded to Hong Kong, and his loss is severely felt; but some time before his death he mentioned in a letter that the meteorological observatory, of which he had urged the necessity, would be started in a few months.

AT the Oxford Commemoration, last week, the honorary degree of D.C.L. was conferred upon Prof. Huxley.

THE organising committee of Section A of the British Association have arranged for the following discussions at the Aberdeen meeting:—(1) On Kinetic Theories of Gases; (2) On Standards of White Light. It would be convenient if those wishing to take part in the discussion would send in their names before the meeting to the Recorder of Section A.

THE Council of the Society of Arts have awarded the Society's silver medals to the following readers of papers during the session 1884-85:—To Anton Jurgens, for his paper on "The Preparation of Butterine." To P. L. Simmonds, for his paper on "Present and Prospective Sources of the Timber Supplies of Great Britain." To A. J. Ellis, B.A., F.R.S., for his paper on "The Musical Scales of Various Nations." To Thomas Wardle, for his paper on "Researches on Silk Fibre." To H. H. Johnston, for his paper on "British Interests in East Africa, especially in the Kilimanjaro District." To E. C. Buck, for his paper on "The Agricultural Resources of India." To Mancherjee M. Bhowmaggree, for his paper on "The Present Condition and Future Prospects of Female Education in India." To Dr. Frederick Siemens, for his paper on "Tempered Glass." To Frederick J. Lloyd, for his paper on "The Chemistry of Ensilage."

IF the few details that have reached us in the form of newspaper accounts are to be relied upon, Clifton Hall Colliery, near Manchester, in which the great explosion occurred on Thursday last, killing 140 men and boys, appears to have been dry and dusty and at the same time very free from firedamp. It remains to be seen whether those who investigate the causes of this accident will give due weight to the now undeniable influence of

coal-dust, instead of contenting themselves with putting forward the usual set of traditional guesses and assumptions, which, it is to be feared, have too often supplied the place of those careful and exhaustive methods of inquiry and deductive reasoning that are alone capable of dealing with the apparent mystery in obscure cases of this kind. It is noteworthy also that this explosion has occurred in the inspection district in which shot-firing is supposed to be altogether prohibited except when the workmen are out of the mine; and it will be a curious commentary upon the late high-handed attempt of the Home Office to force a rule of the same kind upon the other mining districts of the country, should it turn out that the accident in question was not originated by a shot but was due to some other cause, such as the ignition of a local accumulation of fire damp. We await the result of the inquiry with very great interest.

MR. J. R. HENDERSON, M.B. (Edin.), F.L.S., zoologist of the Scottish Marine Station, Edinburgh, has been appointed Professor of Biology in the Christian College, Madras. This is, we understand, the first Professorship of Biology which has been founded in India. Mr. Henderson had a very distinguished career in the University, being awarded, among other honours in natural science, the Dobbie Smith Gold Medal. He is at present engaged in describing the Anomura collected during the *Challenger* Expedition.

PROF. T. C. MENDENHALL, of the University at Columbus, has received an appointment in connection with the United States Signal Service. This is an important accession to the scientific staff of the Meteorological Service of the United States, and is another instance of the enlightened policy carried out by General Hazen, the Chief Signal Officer. The high-class contributions to meteorology we receive from time to time from the office of the Signal Service are the outcome of these appointments.

To the *American Meteorological Journal* for June Mr. H. Allen Hazen sends a short but interesting communication on thunderstorms and air-pressure. Thunderstorms may be divided into (1) common storms with light winds, more or less rain, and generally not very heavy thunder; (2) those preceded or attended by a high and sudden wind; and (3) those that may be termed electric storms, mostly experienced in the west of the States, and of which little has been written or is known up to the present time. As to this third class, it is alleged that storms occur in the west with heavy electric discharges, and more or less wind *but no rain*. These storms the Signal Service proposes to investigate most carefully, particularly since, if it be conclusively shown that thunderstorms occur unaccompanied by any rain, a contribution of no ordinary importance will be made to the theory of the thunderstorm. It gives us the greatest pleasure to learn that the American observers are urged to take readings of their aneroid barometers every five minutes during thunderstorms, together with non-instrumental observations of rain and other accompaniments of the storm. In this department of meteorology, accurately observed facts continue still to be the great desideratum.

DETAILS of the recent violent volcanic eruptions in Java, of which brief telegraphic intelligence has already been published, have now reached Holland. The volcano of Smeru has been active for many years, casting out fire and smoke, but on April 17 and 18 an eruption of extraordinary violence occurred. The mountain is regarded as the highest volcano in Java, and takes the form of a handsome, regular cone. On the present occasion the side of the mountain for one-third of the way down from the summit is described as having been burst open, a tremendous cleft being formed, from which a torrent of lava and mud was ejected. A whole estate called Kalibening was overwhelmed, the manager and a large number of Javanese labourers being

carried away by the torrent. From the reports it appears that the eruption of Smeru was accompanied by volcanic disturbance all over the western part of Java. A mud spring, or rather lake, bubbled up into the Preanger, in West Java; a volcano, Slamat, lying west of the Merapi (itself a quiescent volcano), has manifested signs of renewed activity, as has Klut, farther to the east. Lamongan, lying still farther eastward, throws out showers of ashes, and in Rotti, an island near Timor, mud has issued from the side of a mountain, and has overflowed a district described by the natives as twenty minutes' journey in breadth.

M. GASTON TISSANDIER made, on Friday, June 20, an ascent with a photographic apparatus to take instantaneous views. Not less than twenty-four were obtained on the trip, which began at 2 o'clock and lasted up to 6. The departure took place at Point du Jour (Paris), and the descent in the vicinity of Rheims.

MR. R. ANDERSON, F.C.S., has in the press a new and enlarged edition of his work on "Lightning Conductors, their History, Nature, and Mode of Application." Messrs. Spon are the publishers.

MR. MORRIS, the Government botanist of Jamaica, delivered an address before the Jamaica Institute on the 7th ultimo on the scientific work done, and still to be done, by that establishment, more especially in the local museum. The latter is still in course of formation, but during the past four years there have been brought together collections of the fish, birds, insects, shells, and an illustrative collection of other island productions. The geological collection is described as being of a most complete and useful character. It shows not only the nature, age, and character of the rocks, their chemical constituents, fossil contents, and mineral wealth, but also deals with such topics as the nature and origin of soils, the character and quality of building stone, &c. The collection of Jamaica birds contains about 100 specimens, leaving 89 still to be added before it can be regarded as complete. The insects of Jamaica, Mr. Morris says, are comparatively little known to science, and this field is especially recommended to local collectors. Up to a few years ago the fish of Jamaica could best be studied in Boston and Washington Museums, but the local museum has lately commenced a collection of food fishes, and about 60 species are already carefully arranged and classified. Little, however, has been done of a practical and tangible character to develop the fisheries of the island. 630 species of land and freshwater shells have been found in Jamaica; these are being carefully arranged, and indicate that the island forms a rich province in the class Mollusca, and that "the classes of phenomena within her narrow limits afford room for the highest order of scientific studies." Jamaica is particularly rich in ferns; it contains about 500 species, which is one-sixth of the ferns of the whole world. The orchids and grasses are also being prepared for the museum, and it is hoped as opportunity offers to add a good collection of the medicinal and industrial plants. Here, as in his annual reports, which we have noticed on their appearance, Mr. Morris dwells on the immense economical value of a properly ordered and complete museum to an agricultural colony like Jamaica. There is no lack of materials; the difficulty has been to collect, preserve, and systematically arrange collections and place them in such a state and under such conditions as to conduce to their due and proper utilisation.

IN the first days of August next an International Botanical and Horticultural Congress will be held in Antwerp. Amongst the questions which will be suggested for special consideration is the flora of the new Congo Free State, the methods of culture already existing there, and the possibility of acclimatising new plants. The commission appointed to carry out the preliminary arrangements for the Congress has drawn up a series of ques-

tions, which, with the help of the Association Internationale Africaine, has been sent out to the Congo for replies. A special sitting will be devoted to this subject, and a herbarium of the principal flowers and plants of various neighbourhoods in the State and a collection of fruits and seeds will be accessible to members. The queries sent to the Congo refer to the nature of the soil; the maximum and minimum temperatures; the climatic conditions; the conditions favourable to cultivation, and those which are unfavourable; the food, medicinal, poisonous and industrial plants; the help which Central Africa offers to botanists for the study of tropical flora and physiology; the cultivation of vegetables on the Congo; the principal enemies of cultivation in the vegetable and animal kingdoms; and the best mode in which botanists and gardeners can utilise the labours of the Congo explorers. Like other recent Congresses the International Botanical and Horticultural Congress this year will apparently be mainly occupied with questions relating to Mr. Stanley's new State.

WE have received from Mr. F. W. Putnam, the Curator of the Peabody Museum of American Archaeology and Ethnology, two papers by him: one, a first notice of the pine grove or forest river shell-heap, near Salem; the other, remarks on chipped stone implements, which we noticed on its appearance in the *Bulletin* of the Essex Institute.

MR. J. MACDONALD CAMERON has printed a report on the bituminous deposits of the Camamū basin of the province of Bahia in Brazil. In addition to the purely commercial portion of the report, there is much interesting information with regard to the various descriptions of these oleaginous deposits. Mr. Cameron has some interesting remarks on the influence of the mangrove on the muddy swamps on the coast. The dirty greyish black mud in which the mangrove vegetation is very luxuriant, resembles that noticeable in England in rivers and streams on the banks of which oil or soap works are situated. He inclines to the opinion that this mud is principally formed by the continuous decomposition of the roots and branches of the mangrove trees. The tidal currents ebb and flow slowly, and hence do not sweep away the mud. Thus abundant food for the tree is ensured, "as well as a store of oleaginous material for the use of distant generations of human beings."

WE have received the report of the Hackney Microscopical and Natural History Society for the past year. Mr. Greenhill's paper on Hackney Brook is of much interest, although the title is suggestive of the investigation in the Hampstead ponds undertaken by the immortal Pickwick Society. Mr. Greenhill has hitherto classified the stone implements which he has found in north and north-east London into (1) Hackney brook, (2) Lea valley, (3) Thames valley; and the purport of his paper is to arrive at a sound theory as to the comparative age of these three valleys and their implements. The principal conclusion of the paper is that the brook and its valley were not formed till long after the Stone age. Dr. Cooke's presidential address is a novelty; it is a Christmas vagary, describing the characteristics, the whims and oddities of the individual "chips" who attend one of the society's excursions.

THE Annual Report of the Bedfordshire Natural History Society refers to the work of preparing a new flora of the county. It is hoped that the first part of the work will shortly be ready for print. The *Transactions* of the past two years have contained a complete list of the phanerogams, mosses, and Characeæ of South Bedfordshire, by Mr. Saunders, and attempts are being made to form similar lists for other parts of the county. The papers read were few in number, but these do not represent the work of the Society. A scheme of village lectures on scientific subjects has been carried out with success.

IN a paper read at the last meeting of the Librarians' Association, Mr. J. R. Boosé describes the progress of Colonial public libraries. Commencing with those in the Dominion of Canada, he stated that as far back as 1779 there was a public circulating library at Quebec. He then traced the progress of the public library system up to the present, giving a detailed account of the Parliamentary Library at Ottawa, and also referring to the recent establishment of free public libraries. He then traced the progress made in the Australasian colonies, dealing separately with the libraries of Victoria, and stated that the establishment of public libraries in those colonies only dated from the second decade of the present century. Their growth, however, had been of extraordinary rapidity; the statistics for Victoria showed that there were 143,073 volumes in the public library of Melbourne, 317,295 in the libraries of the colony, and that these institutions were visited in 1883 by 3,100,000 persons. Mr. Boosé, after describing the libraries of the other Australian colonies, referred to those of the Cape Colony, Natal, Singapore, Jamaica, British Guiana, Trinidad, the Bahamas, &c., and, in conclusion, observed that it was scarcely possible to overrate the advantages of these institutions, inasmuch as, in addition to their existing collections of books, every effort was made to enrich them by such valuable works of reference as were too costly to be purchased privately, and were only presented to libraries having a recognised status. He thought therefore that the Colonial Governments should provide means annually for their proper maintenance, and not throw the cost of them on the municipal authorities.

THE additions to the Zoological Society's Gardens during the past week include two Barbary Apes (*Macacus inuus*) from North Africa, presented respectively by Mrs. Allison and Mrs. D. Fox Tarrant; two Common Marmosets (*Hapale jacchus*) from Brazil, presented by Col. Howell Davis; two Brown Bears (*Ursus arctos*) from Russia, presented by Mr. Walter Holdsworth; two Bandicoot Rats (*Mus bandicota*) from India, presented by Col. C. S. Sturt, C.M.Z.S.; an American Robin (*Turdus migratorius*) from North America, presented by Mr. H. Keilich; two Partridges (*Perdix cinerea*), British, presented by Mr. H. J. Snelgrove; an Azara's Fox (*Canis azarae*) from South America, a Pleasant Antelope (*Tragelaphus gratus* ?) from West Africa, six Common Chameleons (*Chamaeleon vulgaris*) from North Africa, purchased; a Japanese Deer (*Cervus sika* ?), three Canadian Beavers (*Castor canadensis*), a Chile Wigeon (*Mareca chiloensis*), seven Australian Wild Ducks (*Anas superciliosa*), bred in the Gardens.

#### OUR ASTRONOMICAL COLUMN

THE PERIODICAL COMETS OF DE VICO AND BARNARD.—As was first pointed out by Prof. Weiss, there is a certain degree of resemblance between the elements of the comet discovered by Barnard in July, 1884, and those of the comet of short period detected by De Vico in August, 1844, which Leverrier considered was probably identical with the comet observed by Lahire at Paris in 1678, though not known to have been seen in the long intervening period. It appears from Brünnow's minute investigation of the orbit of De Vico's comet that the mean motion at perihelion passage in 1844 is not determinable from the observations within very narrow limits, as might rather have been expected, considering the degree of precision with which that comet was observed from the beginning of September to the end of December. Mr. Otto Struve's observations in particular being of remarkable excellence. According to Brünnow's later calculations, the results of which were published in his "Ann Arbor Notices," the mean motion was close upon  $650''$  daily, but he considered that it might be as small as  $640''$  or as large as  $660''$ , or, in other words, that the period of revolution at perihelion passage in September, 1844, might be as long as 2025 days, or it might not exceed 1964 days. Dr. Berberich finds the period of Barnard's comet 1959 days, and Mr. Egbert, of Albany, U.S., 1970 days, so that the periods of the two

comets are pretty accordant; but the interval 1844-1884 does not correspond thereto, and the differences that exist in the other elements, notwithstanding the general similarity remarked by Weiss, point to considerable perturbation in this interval, supposing the identity of the comets. De Vico's comet in the orbit of 1844 could not have approached near to the planet Jupiter, to which body we are accustomed to look, as the great disturber of cometary orbits, but there is the possibility of a very close approach to the planet Mars, and this is also the case in a striking degree with Barnard's comet, which, in Dr. Berberich's last ellipse, is less than  $0^{\circ}08$  of the earth's mean distance from the orbit of Mars in about  $350^{\circ} 50'$  heliocentric longitude; as already pointed out in this column, there may have been a close approach of the two bodies at the end of 1873 or beginning of the following year. The nearest approximation of the orbits of 1844 and 1884 is  $0^{\circ}043$  in heliocentric longitude  $310^{\circ}$ , and there is another approximation,  $0^{\circ}065$ , in  $143^{\circ}$ . At present, however, the identity of the comets of De Vico and Barnard is to be regarded as at least doubtful.

THE DOUBLE-STAR 19 (HEV.) CAMELOPARDI.—The annual proper motion of the principal component of this double-star, which is  $\Sigma 634$ , resulting from a comparison of Groombridge's Catalogue (mean year of observation 1808 4) with the Greenwich Catalogue of 1872, appears to be  $-0^{\circ}297$  in right ascension, and  $+0^{\circ}164$  in declination, the accurate trigonometrical formula being employed. For the relative motion of the smaller component with respect to the principal one, we may compare Struve's epoch for 1834 with a mean of the measures of Dembowski, Flammarion, and Asaph Hall between the years 1875 and 1879, viz.—

1834.15	... Pos. $348^{\circ}57'$	... Dist. $34^{\circ}042$
1877.29	... " $1^{\circ}11'$ ... "	$20^{\circ}303$ .

Whence we find for the annual relative motion in right ascension  $+0^{\circ}858$  and in declination  $-0^{\circ}302$ , and we have thus a confirmation of the opinion expressed by M. Flammarion in his "Catalogue des Étoiles Doubles et Multiples en Mouvement relatif certain," that the smaller component has a real motion, more rapid than that of the principal star, of contrary sign, and not far from parallel to it.

A DAYLIGHT OCCULTATION OF ALDEBARAN.—On July 9, civil reckoning, Aldebaran will be visibly occulted in this country about noon. If the distribution formulae of Littröw and Woolhouse are applied, the following expressions result for finding the Greenwich mean times of disappearance and re-appearance, and the angles from north point—

Disappearance ... July 8, 23h.  $26^{\circ}7m.$   $-[0^{\circ}2369] L + [9^{\circ}5144] M$

Reappearance ... July 9, 0h.  $15^{\circ}3m.$   $+ [9^{\circ}1126] L + [9^{\circ}4189] M$

Angle at Disappearance  $49^{\circ}3 + [0^{\circ}542] L - [8^{\circ}004] M$

Reappearance  $321^{\circ}6 - [0^{\circ}528] L - [8^{\circ}701] M$

Here the latitude of the place is put  $= 50^{\circ} + L$ , and M is the longitude in minutes of time, *positive* towards the *east*. If we apply the formulae to Oxford, we have  $L = +1^{\circ}76$ , and  $M = -5^{\circ}043$  m., and hence

Disappearance, July 8, 23h.  $22^{\circ}0m.$  at  $55^{\circ}$ .

Reappearance July 9, 0h.  $14^{\circ}2m.$  at  $316^{\circ}$ .

It should be added that the above quantities within square brackets are logarithms.

#### ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, JUNE 28 TO JULY 4

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

*At Greenwich on June 28*

Sun rises, 3h. 48m.; souths, 12h. 2m.  $58^{\circ}7s.$ ; sets, 20h. 18m.; decl. on meridian,  $23^{\circ} 16' N.$ ; Sidereal Time at Sunset, 14h. 46m.

Moon (one day after Full) rises, 19h.  $58m.^*$ ; souths, 0h.  $27m.$ ; sets, 4h.  $58m.$ ; decl. on meridian,  $18^{\circ} 1' S.$

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian °
Mercury	3 43	12 8	20 33	24 33 N.
Venus	4 56	13 8	21 20	22 55 N.
Mars	1 50	9 53	17 56	21 25 N.
Jupiter	8 45	15 50	22 55	11 45 N.
Saturn	3 19	11 29	19 39	22 31 N.

\* Indicates that the rising is that of the preceding day.